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10/539,279

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EXAMINER

FORD, NATHAN K

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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|------------------------------|--------------------------------------|---|--|
| Office Action Summary | Application No. 10/539,279 | Applicant(s) NAGATSU, MASAOKI | |
| | Examiner NATHAN K. FORD | Art Unit 1792 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 December 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION*Applicant's Response*

The reply received on December 5, 2007, is acknowledged. Claim 1 is amended; claim 6 is new.

The applicant contends the following:

- i. Ishii does not teach the emission of "evanescent" microwaves.
- ii. Murakawa teaches circular openings in a dielectric supporting member rather than in a slot plate.
- iii. The prior art does not address the isolation of the space in the coaxial waveguide from the space in the vessel by disposing an interplanar o-ring between the first conductor and dielectric plates.
- iv. Okumura does not teach a second conductor plate; therefore, the plasma trap does not extend in the direction of the second conductor as claimed.

The above contentions are addressed as follows:

- i. Ishii does not designate the emitted microwaves as "evanescent." However, the applicant's specification merely states that the claimed plasma generator can emit evanescent waves – it does not limit a discrete structural element absent in conventional microwave devices that affords the additional capability of generating "evanescent" waves. Accordingly, since Ishii in view of Murakawa and Tanaka teach the entirety of the applicant's claimed structure, the prior art apparatus must be inherently capable of generating an "evanescent" wave. Further, a recitation concerning the manner in which a claimed apparatus is to be employed does not differentiate the apparatus from prior art satisfying the claimed structural limitations (*Ex parte Masham*, 2 USPQ2d 1647).
- ii. Murakawa merely demonstrates that microwaves can pass through circular openings, thereby providing a suitable and obvious alternative to the rectangular slots of Ishii. The structural elements of Murakawa are not being incorporated into the apparatus of Ishii; only the shape of Ishii's conductor plate openings are being modified in view of Murakawa's disclosure of suitability. Further, it has been held that the shape configuration of a claimed element is a matter of choice which a person of ordinary skill would have found obvious (*In re Dailey*, 149 USPQ 47).
- iii. Ishii teaches that o-rings seal hermetically and uses them to do so. Ishii also teaches the hermetic sealing of the resonant cavity, although this sealing is effected by other means (13, 1-28). Nevertheless, given these two statements – o-rings seal hermetically and the resonant cavity must be sealed – it would have been

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obvious to one of ordinary skill to seal the cavity by employing o-rings. Figure 15 delineates an embodiment wherein o-rings (86) facilitate the sealing of the cavity, although they are disposed below the second conductor plate rather than between the first-conductor and dielectric plates. Nevertheless, it has been held that rearranging the parts of an invention involves only routine skill in the art (*In re Japikse*, 86 USPQ 70).

- iv. It is true that Okumura does not teach a second conductor plate. However, only the cylindrical portions of the apparatus are to be incorporated within the apparatus of Ishii. When disposed within the latter's chamber for plasma control, the portions extend toward the second conductor plate of Ishii, thereby satisfying the claim limitations.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii et al., US 5,698,036, in view of Murakawa et al., US 6,388,632, and Tanaka et al., US 4,970,435.

Claim 1: Ishii teaches a microwave plasma generator comprising the following:

- A microwave source (50) to generate an excitation microwave (5, 30-35);
- Gas sources (36, 38; Fig. 1);
- A plasma generation vacuum vessel supplied with a gas from the gas sources (Fig. 1);
- A coaxial waveguide (52) to introduce the excitation microwave into the vessel (10, 35ff);
 - Wherein the waveguide is hermetically sealed by the vacuum vessel (5, 40-49);
- A first conductor plate (82) connected to an outer conductor of the coaxial waveguide (11, 55-60);
- A dielectric plate (80) (11, 54-60);
- A second conductor plate (44) connected to a central conductor of the coaxial waveguide (Fig. 15; 5, 50ff);
 - Wherein the second conductor plate has a plurality of openings (60) to emit microwaves into the vessel (Fig. 2A);
- A recess, or resonant cavity, delimited by elements 83 and 83b (Fig. 15).

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Ishii does not teach the plurality of openings in the second conductor plate as being circular, but it is well-known in the art to shape such openings circularly (Fig. 14; 7, 60-67 – Murakawa). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ishii's conductor plate openings to that of a circular shape as disclosed by Murakawa given the latter's indication as to the suitability of such a construction for purposes of plasma deposition.

Ishii does not teach a movable waveguide. Tanaka, disclosing a plasma processing apparatus, teaches a slidable waveguide (92) to maximize particular current values (7, 65-68; 8, 8-12). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the waveguide of Ishii to facilitate its movement in the manner disclosed by Tanaka to maximize current values.

Ishii does not teach the isolation of the resonant cavity from the vessel by availing o-rings disposed between the first conductor and dielectric plates. However, Ishii has previously disclosed the use of o-rings (56) to hermetically seal the waveguide pipe through its intersection with the vessel ceiling (54). Given this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to seal Ishii's resonant cavity with o-rings to maintain a hermetic boundary between the cavity and the vessel.

Claim 2: The remarks under claim 1 address the limitations of claim 2 directed to the coaxial waveguide. Figure 1 of Ishii delineates a substrate support (6) disposed at a position facing the second conductor plate (44). The combination of Tanaka and Ishii under claim 1 teaches the adjustment of the distance between the plate and support.

Claim 3: Ishii's processing chamber is cylindrical (4, 20-25). Tanaka's waveguide intersects the chamber on its central axis; the waveguide must therefore move along the centerline of the chamber. The outline of Ishii's first conductor plate (82) is nominally smaller than the inner diameter of the chamber (Fig. 14).

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii in view of Murakawa and Tanaka and in further view of Okumura et al., US 6,346,915.

Ishii does not teach the cylindrical portion described by the applicant. Figure 1 of Okumura, who discloses a plasma processing apparatus, delineates a cylindrical portion (13) extending downward and peripherally as explained by the applicant. Further, the cylindrical portion bounds a plasma emission gap (14); the gap controls the plasma distribution on the substrate (2,52-57; 6, 19ff). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to supplement Ishii with the cylindrical portion as disclosed and arranged by Okumura to control the plasma distribution on the substrate.

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Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii in view of Murakawa and Tanaka and in further view of Noda, US 5,395,453.

Ishii teaches a microwave source (50) but does not teach a microwave-source driving device to modulate the pulse of the source (50) and effect intermittent driving. Noda, disclosing an apparatus for controlling the oscillation output of a magnetron, teaches microwave source (10) and a driving device (21) to control the pulse output of the source (7, 29-34). The device (21) effects intermittent pulse timing (8, 27ff). Given this, it would have been obvious to one of ordinary skill in the art at the time the invention was made to supplement Ishii's microwave source with the microwave-source driving device of Noda to control the pulse output of the microwave source and effect intermittent pulse driving.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii in view of Murakawa and Tanaka and in further view of Ichiki, US 2004/0244687.

The width of Ishii's slits is 1 mm, but these slits are not circular. Murakawa discloses circular openings but does not specify the diameter. Supplementing this omission is Ichiki, who discloses an apparatus capable of microwave plasma generation [0057]. Ichiki teaches an orifice electrode through which plasma ions are accelerated. The orifices are circular and have a diameter of 1 mm [0035]. Given this teaching, it would have been obvious to one of ordinary skill in the art at the time the invention was made to fashion circular orifices of 1 mm diameter within the grid of Ishii given Ichiki's demonstration as to the suitability of such a construction to achieve the predictable result of conveying plasma particles through a grid.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, THIS ACTION IS MADE FINAL. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan K. Ford whose telephone number is 571-270-1880. The examiner can normally be reached on M-F, 8:30-5:00 EDT. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on 571-272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

/N. K. F./

Examiner, Art Unit 1792

/Michael Cleveland/

Supervisory Patent Examiner, Art Unit 1792